

(ii) Anticipated future technological developments, such as the introduction of HFC-134a in new motor vehicle air conditioners.

(iii) The environmental consequences of refrigerant release and the adverse effects of stratospheric ozone layer depletion.

(iv) As of August 13, 1992, the requirements imposed by the Administrator under section 609 of the Act.

(3) *Test administration.* Completed tests must be graded by an entity or individual who receives no benefit based on the outcome of testing; a fee may be charged for grading. Sufficient measures must be taken at the test site to ensure that tests are completed honestly by each technician. Each test must provide a means of verifying the identification of the individual taking the test. Programs are encouraged to make provisions for non-English speaking technicians by providing tests in other languages or allowing the use of a translator when taking the test. If a translator is used, the certificate received must indicate that translator assistance was required.

(4) *Proof of certification.* Each certification program must offer individual proof of certification, such as a certificate, wallet-sized card, or display card, upon successful completion of the test. Each certification program must provide a unique number for each certified technician.

(b) In deciding whether to approve an application, the Administrator will consider the extent to which the applicant has documented that its program meets the standards set forth in this section. The Administrator reserves the right to consider other factors deemed relevant to ensure the effectiveness of certification programs. The Administrator may approve a program which meets all of the standards in paragraph (a) of this section except test administration if the program, when viewed as a whole, is at least as effective as a program that does meet all the standards. Such approval shall be limited to training and certification conducted before August 13, 1992. If approval is denied under this section, the Administrator shall give written notice to the program setting forth the basis for his determination.

(c) *Technical revisions.* Directors of approved certification programs must conduct periodic reviews of test subject material and update the material based upon the latest technological developments in motor vehicle air conditioner service and repair. A written summary of the review and any changes made must be submitted to the Administrator every two years.

(d) *Recertification.* The Administrator reserves the right to specify the need for technician recertification at some future date, if necessary.

(e) If at any time an approved program is conducted in a manner not consistent with the representations made in the application for approval of the program under this section, the Administrator reserves the right to revoke approval.

(f) Authorized representatives of the Administrator may require technicians to demonstrate on the business entity's premises their ability to perform proper procedures for recovering and/or recycling refrigerant. Failure to demonstrate or failure to properly use the equipment may result in revocation of the technician's certificate by the Administrator. Technicians whose certification is revoked must be recertified before servicing or repairing any motor vehicle air conditioners.

[57 FR 31261, July 14, 1992, as amended at 60 FR 21688, May 2, 1995; 62 FR 68048, Dec. 30, 1997]

§ 82.42 Certification, recordkeeping and public notification requirements.

(a) *Certification requirements.* (1) No later than January 1, 1993, any person repairing or servicing motor vehicle air conditioners for consideration shall certify to the Administrator that such person has acquired, and is properly using, approved equipment and that each individual authorized to use the equipment is properly trained and certified. Certification shall take the form of a statement signed by the owner of the equipment or another responsible officer and setting forth:

(i) The name of the purchaser of the equipment;

(ii) The address of the establishment where the equipment will be located; and

(iii) The manufacturer name and equipment model number, the date of manufacture, and the serial number of the equipment. The certification must also include a statement that the equipment will be properly used in servicing motor vehicle air conditioners, that each individual authorized by the purchaser to perform service is properly trained and certified in accordance with §82.40, and that the information given is true and correct. The certification should be sent to: MVACs Recycling Program Manager, Stratospheric Protection Division, (6205J), U.S. Environmental Protection Agency, 401 M Street, SW., Washington, DC 20460.

(2) The prohibitions in §82.34(a) shall be effective as of January 1, 1993 for persons repairing or servicing motor vehicle air conditioners for consideration at an entity which performed service on fewer than 100 motor vehicle air conditioners in calendar year 1990, but only if such person so certifies to the Administrator no later than August 13, 1992. Persons must retain adequate records to demonstrate that the number of vehicles serviced was fewer than 100.

(3) Certificates of compliance are not transferable. In the event of a change of ownership of an entity which services motor vehicle air conditioners for consideration, the new owner of the entity shall certify within thirty days of the change of ownership pursuant to §82.42(a)(1).

(b) *Recordkeeping requirements.* (1) Any person who owns approved refrigerant recycling equipment certified under §82.36(a)(2) must maintain records of the name and address of any facility to which refrigerant is sent.

(2) Any person who owns approved refrigerant recycling equipment must retain records demonstrating that all persons authorized to operate the equipment are currently certified under §82.40.

(3) Any person who sells or distributes any class I or class II substance that is suitable for use as a refrigerant in a motor vehicle air conditioner and that is in a container of less than 20 pounds of such refrigerant must verify that the purchaser is properly trained and certified under §82.40. The seller

must have a reasonable basis for believing that the information presented by the purchaser is accurate. The only exception to these requirements is if the purchaser is purchasing the small containers for resale only. In this case, the seller must obtain a written statement from the purchaser that the containers are for resale only and indicate the purchaser's name and business address. Records required under this paragraph must be retained for a period of three years.

(4) All records required to be maintained pursuant to this section must be kept for a minimum of three years unless otherwise indicated. Entities which service motor vehicle air conditioners for consideration must keep these records on-site.

(5) All entities which service motor vehicle air conditioners for consideration must allow an authorized representative of the Administrator entry onto their premises (upon presentation of his or her credentials) and give the authorized representative access to all records required to be maintained pursuant to this section.

(c) *Public notification.* Any person who conducts any retail sales of a class I or class II substance that is suitable for use as a refrigerant in a motor vehicle air conditioner, and that is in a container of less than 20 pounds of refrigerant, must prominently display a sign where sales of such containers occur which states:

"It is a violation of federal law to sell containers of Class I and Class II refrigerant of less than 20 pounds of such refrigerant to anyone who is not properly trained and certified to operate approved refrigerant recycling equipment."

[57 FR 31261, July 14, 1992, as amended at 60 FR 21688, May 2, 1995]

APPENDIX A TO SUBPART B OF PART 82— STANDARD FOR RECYCLE/RECOVER EQUIPMENT

STANDARD OF PURITY FOR USE IN MOBILE AIR- CONDITIONING SYSTEMS

Foreword

Due to the CFC's damaging effect on the ozone layer, recycle of CFC-12 (R-12) used in mobile air-conditioning systems is required to reduce system venting during normal service operations. Establishing recycle

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specifications for R-12 will assure that system operation with recycled R-12 will provide the same level of performance as new refrigerant.

Extensive field testing with the EPA and the auto industry indicate that reuse of R-12 removed from mobile air-conditioning systems can be considered, if the refrigerant is cleaned to a specific standard. The purpose of this standard is to establish the specific minimum levels of R-12 purity required for recycled R-12 removed from mobile automotive air-conditioning systems.

1. Scope

This information applies to refrigerant used to service automobiles, light trucks, and other vehicles with similar CFC-12 systems. Systems used on mobile vehicles for refrigerated cargo that have hermetically sealed, rigid pipe are not covered in this document.

2. References

SAE J1989, Recommended Service Procedure for the Containment of R-12
SAE J1990, Extraction and Recycle Equipment for Mobile Automotive Air-Conditioning Systems
ARI Standard 700-88

3. Purity Specification

The refrigerant in this document shall have been directly removed from, and intended to be returned to, a mobile air-conditioning system. The contaminants in this recycled refrigerant 12 shall be limited to moisture, refrigerant oil, and noncondensable gases, which shall not exceed the following level:

3.1 *Moisture*: 15 ppm by weight.

3.2 *Refrigerant Oil*: 4000 ppm by weight.

3.3 *Noncondensable Gases (air)*: 330 ppm by weight.

4. Refrigeration Recycle Equipment Used in Direct Mobile Air-Conditioning Service Operations Requirement

4.1 The equipment shall meet SAE J1990, which covers additional moisture, acid, and filter requirements.

4.2 The equipment shall have a label indicating that it is certified to meet this document.

5. Purity Specification of Recycled R-12 Refrigerant Supplied in Containers From Other Recycle Sources

Purity specification of recycled R-12 refrigerant supplied in containers from other recycle sources, for service of mobile air-conditioning systems, shall meet ARI Standard 700-88 (Air Conditioning and Refrigeration Institute).

6. Operation of the Recycle Equipment

This shall be done in accordance with SAE J1989.

Rationale

Not applicable.

Relationship of SAE Standard to ISO Standard

Not applicable.

Reference Section

SAE J1989, Recommended Service Procedure for the Containment of R-12
SAE J1990, Extraction and Recycle Equipment for Mobile Automotive Air-Conditioning Systems
ARI Standard 700-88

Application

This information applies to refrigerant used to service automobiles, light trucks, and other vehicles with similar CFC-12 systems. Systems used on mobile vehicles for refrigerated cargo that have hermetically sealed, rigid pipe are not covered in this document.

Committee Composition

DEVELOPED BY THE SAE DEFROST AND INTERIOR CLIMATE CONTROLS STANDARDS COMMITTEE

W.J. Atkinson, Sun Test Engineering, Paradise Valley, AZ—Chairman
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D.F. Last, GMC, Troy, MI
D.E. Linn, Volkswagen of America, Warren, MI
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N. Novak, Chrysler Corp., Detroit, MI
S. Oulouhojian, Mobile Air Conditioning Society, Upper Darby, PA
J. Phillips, Air International, Australia
R.H. Proctor, Murray Corp., Cockeysville, MD
G. Rolling, Behr America Inc., Ft. Worth, TX
C.D. Sweet, Signet Systems Inc., Harrodsburg, KY
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EXTRACTION AND RECYCLE EQUIPMENT FOR MOBILE AUTOMOTIVE AIR CONDITIONING SYSTEMS

SAE Recommended Practice, SAE J1990
(1991)¹

0. Foreword

Due to the CFC's damaging effect on the ozone layer, recycle of CFC-12 (R-12) used in mobile air-conditioning systems is required to replace system venting during normal service operations. Establishing recycle specifications for R-12 will provide the same level of performance as new refrigerant.

Extensive field testing with the EPA and the auto industry indicates that R-12 can be reused, provided that it is cleaned to specifications in SAE J1991. The purpose of this document is to establish the specific minimum equipment specification required for recycle of R-12 that has been directly removed from mobile systems for reuse in mobile automotive air-conditioning systems.

1. Scope

The purpose of this document is to provide equipment specifications for CFC-12 (R-12) recycling equipment. This information applies to equipment used to service automobiles, light trucks, and other vehicles with similar CFC-12 air-conditioning systems. Systems used on mobile vehicles for refrigerated cargo that have hermetically sealed systems are not covered in this document. The equipment in this document is intended for use with refrigerant that has been directly removed from, and intended to be returned to, a mobile air-conditioning system. Should other revisions due to operational or technical requirements occur, this document may be amended.

2. References

2.1 Applicable Documents:

2.1.1 SAE Publications—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J1991—Standard of Purity for Use in Mobile Air-Conditioning Systems

SAE J2196—Service Hose for Automotive Air-Conditioning

¹This standard is appropriate for equipment certified after February 1, 1992. This equipment may be marked design certified for compliance with SAE J1990 (1991). The standard for approval for equipment certified on or before February 1, 1992 is SAE J1990 (1989). This equipment may be marked design certified for compliance with SAE J1990 (1989). Both types of equipment are considered approved under the requirements of this regulation.

2.1.2 CGA Publications—Available from CGA, Crystal Gateway #1, Ste. 501, 1235 Jefferson Davis Hwy., Arlington, VA 22202

CGA Pamphlet S-1.1—Pressure Relief Device Standard Part 1—Cylinders for Compressed Gases

3. Specification and General Description

3.1 The equipment must be able to extract and process CFC-12 from mobile air-conditioning systems. The equipment shall process the contaminated R-12 samples as defined in 8.4 and shall clean the refrigerant to the level as defined in SAE J1991.

3.2 The equipment shall be suitable for use in an automotive service environment and be capable of continuous operation in ambients from 10 to 49 °C.

3.3 The equipment must be certified by Underwriters Laboratories or an equivalent certifying laboratory.

3.4 The equipment shall have a label "Design Certified by (Company Name) to Meet SAE J1991". The minimum letter size shall be bold type 3 mm in height.

4. Refrigeration Recycle Equipment Requirements

4.1 Moisture and Acid—The equipment shall incorporate a desiccant package that must be replaced before saturated with moisture and whose mineral acid capacity is at least 5% by weight of total system dry desiccant.

4.1.1 The equipment shall be provided with a moisture detection device that will reliably indicate when moisture in the CFC-12 exceeds the allowable level and requires the filter/dryer replacement.

4.2 Filter—The equipment shall incorporate an in-line filter that will trap particulates of 15 µm or greater.

4.3 Noncondensable Gas.

4.3.1 The equipment shall either automatically purge noncondensables (NCGs) if the acceptable level is exceeded or incorporate a device to alert the operator that NCG level has been exceeded. NCG removal must be part of normal operation of the equipment and instructions must be provided to enable the task to be accomplished within 30 minutes.

4.3.2 Refrigerant loss from noncondensable gas purging during testing described in Section 8 shall not exceed five percent (5%) by weight of the total contaminated refrigerant removed from the test system.

4.3.3 Transfer of Recycled Refrigerant—Recycled refrigerant for recharging and transfer shall be taken from the liquid phase only.

5. Safety Requirements

5.1 The equipment must comply with applicable federal, state and local requirements on equipment related to the handling of R-12

material. Safety precautions or notices related to the safe operation of the equipment shall be prominently displayed on the equipment and should also state "Caution—Should Be Operated By Qualified Personnel".

6. Operating Instructions

6.1 The equipment manufacturer must provide operating instructions, necessary maintenance procedures, and source information for replacement parts and repair.

6.2 The equipment must prominently display the manufacturer's name, address and any items that require maintenance or replacement that affect the proper operation of the equipment. Operation manuals must cover information for complete maintenance of the equipment to assure proper operation.

7. Functional Description

7.1 The equipment must be capable of ensuring recovery of the R-12 from the system being service, by reducing the system pressure below atmospheric to a minimum of 102 mm of mercury.

7.2 To prevent overcharge, the equipment must be equipped to protect the tank used to store the recycled refrigerant with a shutoff device and a mechanical pressure relief valve.

7.3 Portable refillable tanks or containers used in conjunction with this equipment must meet applicable Department of Transportation (DOT) or Underwriters Laboratories (UL) Standards and be adaptable to existing refrigerant service and charging equipment.

7.4 During operation, the equipment shall provide overfill protection to assure the storage container, internal or external, liquid fill does not exceed 80% of the tank's rated volume at 21.1 °C (70 °F) per DOT standards, CFR title 49, §173.304 and American Society of Mechanical Engineers.

7.4.1 Additional Storage Tank Requirements.

7.4.1.1 The cylinder valve shall comply with the standard for cylinder valves, UL 1769.

7.4.1.2 The pressure relief device shall comply with the Pressure Relief Device Standard Part 1—Cylinders for Compressed Gases, CGA Pamphlet S-1.1.

7.4.1.3 The tank assembly shall be marked to indicate the first retest date, which shall be 5 years after date of manufacture. The marking shall indicate that retest must be performed every subsequent 5 years. The marking shall be in letters at least ¼ in high.

7.5 All flexible hoses must meet SAE J2196 hose specification effective January 1, 1992.

7.6 Service hoses must have shutoff devices located within 30 cm (12 in) of the connection point to the system being serviced to

minimize introduction of noncondensable gases into the recovery equipment and the release of the refrigerant when being disconnected.

7.7 The equipment must be able to separate the lubricant from the recovered refrigerant and accurately indicate the amount removed during the process, in 30 ml units. Refrigerant dissolves in lubricant sample. This creates the illusion that more lubricant has been recovered than actually has been. The equipment lubricant measuring system must take in account such dissolved refrigerant to prevent overcharging the vehicle system with lubricant. Note: Use only new lubricant to replace the amount removed during the recycle process. Used lubricant should be discarded per applicable federal, state, and local requirements.

7.8 The equipment must be capable of continuous operation in ambient of 10 to 49 °C (50 to 120 °F).

7.9 The equipment should be compatible with leak detection material that may be present in the mobile AC system.

8. Testing

This test procedure and the requirement are used for evaluation of the equipment for its ability to clean the contaminated R-12 refrigerant.

8.1 The equipment shall clean the contaminated R-12 refrigerant to the minimum purity level as defined in SAE J1991, when tested in accordance with the following conditions:

8.2 For test validation, the equipment is to be operated according to the manufacturer's instructions.

8.3 The equipment must be preconditioned with 13.6 kg (30 lb) of the standard contaminated R-12 at an ambient of 21 °C (70 °F) before starting the test cycle. Sample amounts are not to exceed 1.13 kg (2.5 lb) with sample amounts to be repeated every 5 min. The sample method fixture, defined in Fig. 1, shall be operated at 24 °C (75 °F).

8.4 Contaminated R-12 Samples.

8.4.1 Standard contaminated R-12 refrigerant shall consist of liquid R-12 with 100 ppm (by weight) moisture at 21 °C (70 °F) and 45,000 ppm (by weight) mineral oil 525 suspension nominal and 770 ppm by weight of non-condensable gases (air).

8.4.2 High moisture contaminated sample shall consist of R-12 vapor with 1,000 ppm (by weight) moisture.

8.4.3 High oil contaminated sample shall consist of R-12 with 200,000 ppm (by weight) mineral oil 525 suspension viscosity nominal.

8.5 Test Cycle.

8.5.1 After preconditioning as stated in 8.3, the test cycle is started, processing the following contaminated samples through the equipment:

8.5.1.1 3013.6 kg (30 lb) of standard contaminated R-12.

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8.5.1.2 1 kg (2.2 lb) of high oil contaminated R-12.

8.5.1.3 4.5 kg (10 lb) of standard contaminated R-12.

8.5.1.4 1 kg (2.2 lb) of high moisture contaminated R-12.

8.6 Equipment Operating Ambient.

8.6.1 The R-12 is to be cleaned to the minimum purity level, as defined in SAE J1991, with the equipment operating in a stable ambient of 10, 21, and 49 °C (50, 70, and 120 °F) and processing the samples as defined in 8.5.

8.7 Sample Analysis.

8.7.1 The processed contaminated sample shall be analyzed according to the following procedure.

8.8 Quantitative Determination of Moisture.

8.8.1 The recycled liquid phase sample of CFC-12 shall be analyzed for moisture content via Karl Fischer coulometer titration or an equivalent method. The Karl Fischer apparatus is an instrument for precise determination of small amounts of water dissolved in liquid and/or gas samples.

8.8.2 In conducting the test, a weighed sample of 30 to 130 grams is vaporized directly into the Karl Fischer analyte. A coulometer titration is conducted and the results are calculated and displayed as parts per million moisture (weight).

8.9 Determination of Percent Lubricant.

8.9.1 The amount of oil in the recycled sample of CFC-12 is to be determined by gravimetric analysis.

8.9.2 Following venting of noncondensable, in accordance with the manufacturer's operating instructions, the refrigerant con-

tainer shall be shaken for 5 minutes prior to extracting samples for test.

8.9.3 A weighted sample of 175 to 225 grams of liquid CFC-12 is allowed to evaporate at room temperature. The percent oil is to be calculated from the weight of the original sample and the residue remaining after the evaporation.

8.10 Noncondensable Gas.

8.10.1 The amount of noncondensable gas is to be determined by gas chromatography. A sample of vaporized refrigerant liquid shall be separated and analyzed by gas chromatography. A Porapak Q column at 130 °C and a hot wire detector may be used for analysis.

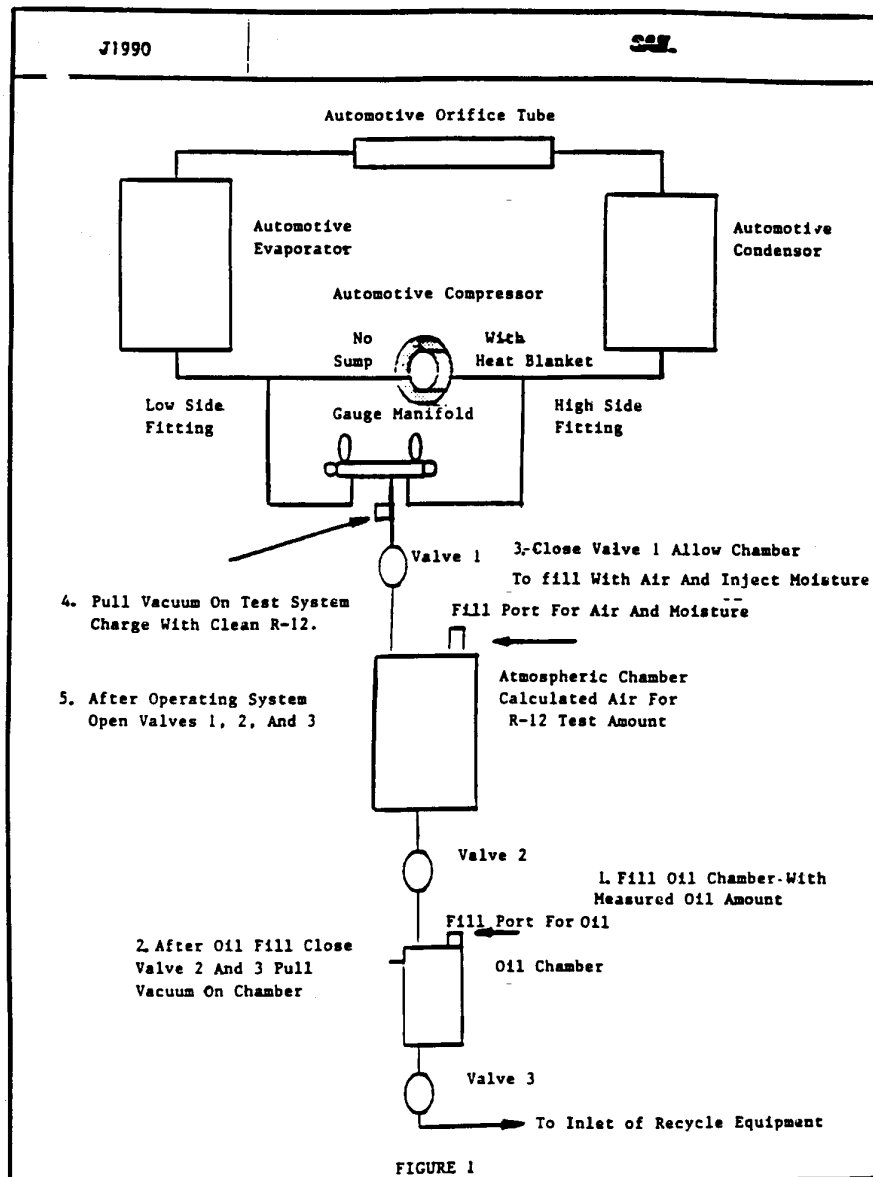
8.10.2 This test shall be conducted on recycled refrigerant (taken from the liquid phase) within 30 minutes after the proper venting of noncondensable.

8.10.3 Samples shall be shaken for 8 hours prior to retesting while at a temperature of 24 ± 2.8 °C (75 ± 5 °F). Known volumes of refrigerant vapor are to be injected for separation and analysis by means of gas chromatography. A Porapak Q column at 130 °C (266 °F) and a hot wire detector are to be used for the analysis.

8.10.4 This test shall be conducted at 21 and 49 °C and may be performed in conjunction with the testing defined in Section 8.6. The equipment shall process at least 13.6 kg of standard contaminated refrigerant for this test.

8.11 Sample Requirements.

8.11.1 The sample shall be tested as defined in 8.7, 8.8, 8.9, and 8.10 at ambient temperatures of 10, 21, and 49 °C (50, 70, and 120 °F) as defined in 8.6.1.



RECOMMENDED SERVICE PROCEDURE FOR THE CONTAINMENT OF R-12

1. Scope

During service of mobile air-conditioning systems, containment of the refrigerant is

important. This procedure provides service guidelines for technicians when repairing vehicles and operating equipment defined in SAE J1990.

2. References

SAE J1990, Extraction and Recycle Equipment for Mobile Automotive Air-Conditioning Systems

3. Refrigerant Recovery Procedure

3.1 Connect the recovery unit service hoses, which shall have shutoff valves within 12 in (30 cm) of the service ends, to the vehicle air-conditioning system service ports.

3.2 Operate the recovery equipment as covered by the equipment manufacturers recommended procedure.

3.2.1 Start the recovery process and remove the refrigerant from the vehicle AC system. Operate the recovery unit until the vehicle system has been reduced from a pressure to a vacuum. With the recovery unit shut off for at least 5 min, determine that there is no refrigerant remaining in the vehicle AC system. If the vehicle system has pressure, additional recovery operation is required to remove the remaining refrigerant. Repeat the operation until the vehicle AC system vacuum level remains stable for 2 min.

3.3 Close the valves in the service lines and then remove the service lines from the vehicle system. Proceed with the repair/service. If the recovery equipment has automatic closing valves, be sure they are properly operating.

4. Service With Manifold Gage Set

4.1 Service hoses must have shutoff valves in the high, low, and center service hoses within 12 in (30 cm) of the service ends. Valves must be closed prior to hose removal

from the air-conditioning system. This will reduce the volume of refrigerant contained in the service hose that would otherwise be vented to atmosphere.

4.2 During all service operations, the valves should be closed until connected to the vehicle air-conditioning system or the charging source to avoid introduction of air and to contain the refrigerant rather than vent open to atmosphere.

4.3 When the manifold gage set is disconnected from the air-conditioning system or when the center hose is moved to another device which cannot accept refrigerant pressure, the gage set hoses should first be attached to the reclaim equipment to recover the refrigerant from the hoses.

5. Recycled Refrigerant Checking Procedure for Stored Portable Auxiliary Container

5.1 To determine if the recycled refrigerant container has excess noncondensable gases (air), the container must be stored at a temperature of 65 °F (18.3 °C) or above for a period of time, 12 h, protected from direct sun.

5.2 Install a calibrated pressure gage, with 1 psig divisions (0.07 kg), to the container and determine the container pressure.

5.3 With a calibrated thermometer, measure the air temperature within 4 in (10 cm) of the container surface.

5.4 Compare the observed container pressure and air temperature to determine if the container exceeds the pressure limits found on Table 1, e.g., air temperature 70 °F (21 °C) pressure must not exceed 80 psig (5.62 kg/cm²).

TABLE 1

Temp °F	Psig	Temp °F	Psig	Temp °F	Psig	Temp °F	Psig	Temp °F	Psig
65	74	75	87	85	102	95	118	105	136
66	75	76	88	86	103	96	120	106	138
67	76	77	90	87	105	97	122	107	140
68	78	78	92	88	107	98	124	108	142
69	79	79	94	89	108	99	125	109	144
70	80	80	96	90	110	100	127	110	146
71	82	81	98	91	111	101	129	111	148
72	83	82	99	92	113	102	130	112	150
73	84	83	100	93	115	103	132	113	152
74	86	84	101	94	116	104	134	114	154

TABLE 1 (METRIC)

Temp °C	Pres	Temp °C	Pres	Temp °C	Pres	Temp °C	Pres	Temp °C	PRres
18.3	5.20	23.9	6.11	29.4	7.17	35.0	8.29	40.5	9.56
18.8	5.27	24.4	6.18	30.0	7.24	35.5	8.43	41.1	9.70
19.4	5.34	25.0	6.32	30.5	7.38	36.1	8.57	41.6	9.84
20.0	5.48	25.5	6.46	31.1	7.52	36.6	8.71	42.2	9.98
20.5	5.55	26.1	6.60	31.6	7.59	37.2	8.78	42.7	10.12
21.1	5.62	26.6	6.74	32.2	7.73	37.7	8.92	43.3	10.26
21.6	5.76	27.2	6.88	32.7	7.80	38.3	9.06	43.9	10.40
22.2	5.83	27.7	6.95	33.3	7.94	38.8	9.13	44.4	10.54
22.7	5.90	28.3	7.03	33.9	8.08	39.4	9.27	45.0	10.68
23.3	6.04	28.9	7.10	34.4	8.15	40.0	9.42	45.5	10.82

Pres kg/sq cm.

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5.5 If the container pressure is less than the Table 1 values and has been recycled, limits of noncondensable gases (air) have not been exceeded and the refrigerant may be used.

5.6 If the pressure is greater than the range and the container contains recycled material, slowly vent from the top of the container a small amount of vapor into the recycle equipment until the pressure is less than the pressure shown on Table 1.

5.7 If the container still exceeds the pressure shown on Table 1, the entire contents of the container shall be recycled.

6. Containers for Storage of Recycled Refrigerant

6.1 Recycled refrigerant should not be salvaged or stored in disposable refrigerant containers. This is the type of container in which virgin refrigerant is sold. Use only DOT CFR title 49 or UL approved storage containers for recycled refrigerant.

6.2 Any container of recycled refrigerant that has been stored or transferred must be checked prior to use as defined in section 5.

7. Transfer of Recycled Refrigerant

7.1 When external portable containers are used for transfer, the container must be evacuated at least 27 in of vacuum (75 mm Hg absolute pressure) prior to transfer of the recycled refrigerant. External portable containers must meet DOT and UL standards.

7.2 To prevent on-site overfilling when transferring to external containers, the safe filling level must be controlled by weight and must not exceed 60% of container gross weight rating.

8. Disposal of Empty/Near Empty Containers

8.1 Since all the refrigerant may not be removed from disposable refrigerant containers during normal system charging procedures, empty/near empty container contents should be reclaimed prior to disposal of the container.

8.2 Attach the container to the recovery unit and remove the remaining refrigerant. When the container has been reduced from a pressure to a vacuum, the container valve can be closed. The container should be marked empty and is ready for disposal.

Rationale

Not applicable.

Relationship of SAE Standard to ISO Standard.

Not applicable.

Reference Section

SAE J1990, Extraction and Recycle Equipment for Mobile Automotive Air-Conditioning Systems

Application

During service of mobile air-conditioning systems, containment of the refrigerant is important. This procedure provides service guidelines for technicians when repairing vehicles and operating equipment defined in SAE J1990.

Committee Composition

Developed by the SAE Defrost and Interior Climate Control Standards Committee

W.J. Atkinson, Sun Test Engineering, Paradise Valley, AZ—Chairman
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R.J. Niemiec, General Motors Corp., Pontiac, MI
N. Novak, Chrysler Corp., Detroit, MI
S. Oulouhojian, Mobile Air Conditioning Society, Upper Darby, PA
J. Phillips, Air International, Australia
R.H. Proctor, Murray Corp., Cockeysville, MD
G. Rolling, Behr America Inc., Ft. Worth, TX
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APPENDIX B TO SUBPART B OF PART 82—STANDARD FOR RECOVER EQUIPMENT

SAE J1989, Recommended Service Procedure for the Containment of R-12, as set forth under Appendix A, also applies to this Appendix B.

SAE J2209, issued June, 1992.

SAE RECOMMENDED PRACTICE: CFC-12 (R-12) EXTRACTION EQUIPMENT FOR MOBILE AUTOMOTIVE AIR-CONDITIONING SYSTEMS

Foreword

CFCs deplete the stratospheric ozone layer that protects the earth against harmful ultraviolet radiation. To reduce the emissions of CFCs, the 1990 Clean Air Act requires recycle of CFC-12 (R-12) used in mobile air-conditioning systems to eliminate system

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venting during service operations. SAE J1990 establishes equipment specifications for on-site recovery and reuse of CFCs in mobile air-conditioning systems. Establishing extraction equipment specifications for CFC-12 will provide service facilities with equipment to assure that venting of refrigerant will not occur.

1. Scope

The purpose of this document is to provide equipment specifications for CFC-12 (R-12) recovery for recycling on-site or for transport off-site to a refrigerant reclamation facility that will process it to ARI (Air-Conditioning and Refrigeration Institute) standard 700-93 as a minimum. It is not acceptable that the refrigerant removed from a mobile air-conditioning system, with this equipment, be directly returned to a mobile air-conditioning system.

This information applies to equipment used to service automobiles, light trucks, and other vehicles with similar CFC-12 systems.

2. References

2. Applicable Documents—The following documents form a part of this specification to the extent specified herein.

2.1.1 SAE Publications—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J639—Vehicle Service Coupling

SAE J1990—Extraction and Recycle Equipment for Mobile Automotive Air-Conditioning Systems

SAE J2196—Service Hose for Automotive Air-Conditioning

2.1.2 ARI Publications—Available from Air-Conditioning and Refrigeration Institute, 1501 Wilson Boulevard, Sixth Floor, Arlington, VA 22209.

ARI 700-93—Specifications for Fluorocarbon Refrigerants

2.1.3 CGA Publications—Available from CGA, Crystal Gateway #1, Suite 501, 1235 Jefferson Davis Highway, Arlington, VA 22202.

CGA S-1.1—Pressure Relief Device Standard Part 1—Cylinders for Compressed Gases

2.1.4 DOT Specifications—Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

49 CFR, Section 173.304—Shippers—General Requirements for Shipments and Packagings

2.1.5 UL Publications—Available from Underwriters Laboratories, 333 Pfingsten Road, Northbrook, IL 60062-2096.

UL 1769—Cylinder Valves

3. Specifications and General Description

3.1 The equipment must be able to extract CFC-12 from a mobile air-conditioning system.

3.2 The equipment discharge or transfer fitting shall be unique to prevent the unintentional use of extracted CFC-12 to be used for recharging auto air conditioners.

3.3 The equipment shall be suitable for use in an automotive service garage environment as defined in 6.8.

3.4 Equipment Certification—The equipment must be certified by Underwriters Laboratories or an equivalent certifying laboratory to meet this standard.

3.5 Label Requirements—The equipment shall have a label "Design Certified by (company name) to meet SAE J2209 for use with CFC-12. The refrigerant from this equipment must be processed to ARI 700-93 specifications before reuse in a mobile air-conditioning system." The minimum letter size shall be bold type 3mm in height.

4. Safety Requirements

4.1 The equipment must comply with applicable federal, state and local requirements on equipment related to the handling of R-12 material. Safety precautions or notices or labels related to the safe operation of the equipment shall also be prominently displayed on the equipment and should also state "CAUTION—SHOULD BE OPERATED BY CERTIFIED PERSONNEL." The safety identification shall be located on the front near the controls.

4.2 The equipment must comply with applicable safety standards for electrical and mechanical requirements.

5. Operating Instructions

5.1 The equipment manufacturer must provide operating instructions, necessary maintenance procedures and source information for replacement parts and repair.

5.2 The equipment must prominently display the manufacturer's name, address and any items that require maintenance or replacement that affect the proper operation of the equipment. Operation manuals must cover information for complete maintenance of the equipment to assure proper operation.

6. Functional Description

6.1 The equipment must be capable of ensuring recovery of the CFC-12 from the system being serviced, by reducing the system pressure to a minimum of 102 mm of mercury below atmospheric. To prevent system delayed outgassing, the unit must have a device that assures that the refrigerant has been recovered from the air-conditioning system.

6.1.1 Testing laboratory certification of the equipment capability is required which

shall process contaminated refrigerant samples at specific temperatures.

6.2 The equipment must be preconditioned with 13.6 kg of the standard contaminated CFC-12 at an ambient of 21 °C before starting the test cycle. Sample amounts are not to exceed 1.13 kg with sample amounts to be repeated every 5 minutes. The sample method fixture defined in Figure 1 of appendix A shall be operated at 24 °C. Contaminated CFC-12 samples shall be processed at ambient temperatures of 10 and 49 °C.

6.2.1 Contaminated CFC-12 sample.

6.2.2 Standard contaminated CFC-12 refrigerant, 13.6 Kg sample size, shall consist of liquid CFC-12 with 100 ppm (by weight) moisture at 21 °C and 45,000 ppm (by weight) mineral oil 525 suspension nominal and 770 ppm (by weight) of noncondensable gases (air).

6.3 Portable refillable containers used in conjunction with this equipment must meet applicable DOT standards.

6.3.1 The container color must be gray with yellow top to identify that it contains used CFC-12 refrigerant. It must be permanently marked on the outside surface in black print at least 20 mm high "DIRTY R-12—DO NOT USE, MUST BE REPROCESSED".

6.3.2 The portable refillable container shall have a SAE 3/8 inch flare male thread connection as identified in SAE J639 CFC-12 High Pressure Charging Valve Figure 2.

6.3.3 During operation the equipment shall provide overfill protection to assure that the storage container liquid fill does not exceed 80% of the tank's rated volume at 21 °C per DOT standard, CFR Title 49, section 173.304 and the American Society of Mechanical Engineers.

6.4 Additional Storage Tank Requirements.

6.4.1 The cylinder valve shall comply with the standard for cylinder valves, UL 1769.

6.4.2 The pressure relief device shall comply with the pressure relief device standard part 1, CGA pamphlet S-1.1.

6.4.3 The container assembly shall be marked to indicate the first retest date, which shall be 5 years after date of manufacture. The marking shall indicate that retest must be performed every subsequent five years. The marking shall be in letters at least 6 mm high.

6.5 All flexible hoses must meet SAE J2196 standard for service hoses.

6.6 Service hoses must have shutoff devices located within 30 cm of the connection point to the system being serviced to minimize introduction of noncondensable gases into the recovery equipment during connection and the release of the refrigerant during disconnection.

6.7 The equipment must be able to separate the lubricant from the recovered refrigerant and accurately indicate the amount re-

moved from the system during processing in 30 ml units.

6.7.1 The purpose of indicating the amount of lubricant removed is to ensure that a proper amount is returned to the mobile air-conditioning system for compressor lubrication.

6.7.2 Refrigerant dissolved in this lubricant must be accounted for to prevent system lubricant overcharge of the mobile air-conditioning system.

6.7.3 Only new lubricant, as identified by the system manufacturer, should be replaced in the mobile air-conditioning system.

6.7.4 Removed lubricant from the system and/or the equipment shall be disposed of in accordance with applicable federal, state and local procedures and regulations.

6.8 The equipment must be capable of continuous operation in ambient temperatures of 10 °C to 49 °C and comply with 6.1.

6.9 The equipment should be compatible with leak detection material that may be present in the mobile air-conditioning system.

7.0 For test validation, the equipment is to be operated according to the manufacturer's instructions.

[60 FR 21688, May 2, 1995]

APPENDIX C TO SUBPART B OF PART 82— STANDARD FOR RECOVER/RECYCLE EQUIPMENT FOR HFC-134A REFRIG- ERANT

I. SAE J2210, issued December, 1991.

HFC-134a RECYCLING EQUIPMENT FOR MOBILE AIR CONDITIONING SYSTEMS

Foreword

The purpose of this standard is to establish the specific minimum equipment specification required for the recycling of HFC-134a that has been directly removed from, and is intended for reuse in, mobile air-conditioning systems. Establishing such specifications will assure that system operation with recycled HFC-134a will provide the same level of performance and durability as new refrigerant.

1. Scope

The purpose of this standard is to establish specific minimum equipment requirements for recycling HFC-134a that has been directly removed from, and is intended for reuse in, mobile air-conditioning (A/C) systems.

2. References

Applicable Documents—The following publications form a part of this specification to the extent specified.

2.1.1

Environmental Protection Agency

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SAE Publications—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J2099—Standard of Purity for Recycled HFC-134a for Use in Mobile Air-Conditioning Systems

SAE J2196—Service Hoses for Automotive Air-Conditioning

SAE J2197—Service Hose Fittings for Automotive Air-Conditioning

2.1.2

CGA Publications—Available from CGA, 1235 Jefferson Davis Highway, Arlington, VA 22202.

CGA Pamphlet S-1.1-Pressure Relief Device Standard

Part 1—Cylinders for Compressed Gases

2.1.3

DOT Publications—Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402

DOT Standard, 49 CFR 173.304—Shippers-General Requirements for Shipments and Packagings

2.1.4

UL Publications—Available from Underwriters Laboratories, 333 Pfingsten Road, Northbrook, IL 60062-2096.

UL 1769—Cylinder Valves

UL 1963—Refrigerant Recovery/Recycling Equipment

3. Specification and General Description

- 3.1 The equipment must be able to remove and process HFC-134a from mobile A/C systems to the purity level specified in SAE J2099.
- 3.2 The equipment shall be suitable for use in an automotive service garage environment and be capable of continuous operation in ambients from 10 to 49 °C (50 to 120 °F).
- 3.3 The equipment must be certified that it meets this specification by Underwriters Laboratories (UL) or an equivalent certifying laboratory.
- 3.4 The equipment shall have a label which states "Design Certified by (Certifying Agent) to meet SAE J2210" in bold-type letters a minimum of 3 mm in height.

4. Refrigerant Recycling Equipment Requirements

- 4.1 Moisture and Acid—The equipment shall incorporate a desiccant package that must be replaced before saturation with moisture, and whose mineral acid capacity is at least 5% by weight of the dry desiccant.
 - 4.1.1 The equipment shall be provided with a moisture detection means that will reliably indicate when moisture in the HFC-134a reaches the allowable limit and desiccant replacement is required.

4.2 Filter—The equipment shall incorporate an in-line filter that will trap particulates of 15 micron spherical diameter or greater.

4.3 Noncondensable Gases

4.3.1 The equipment shall either automatically purge noncondensables (NCGs) if the acceptable level is exceeded or incorporate a device that indicates to the operator that the NCG level has been exceeded. NCG removal must be part of the normal operation of the equipment and instructions must be provided to enable the task to be accomplished within 30 minutes.

4.3.2 Refrigerant loss from noncondensable gas purging during the testing described in Section 8 shall not exceed 5% by weight of the total contaminated refrigerant removed from the test system.

4.4 Recharging and Transfer of Recycled Refrigerant—Recycled refrigerant for recharging and transfer shall be taken from the liquid phase only.

5. Safety Requirements

- 5.1 The equipment must comply with applicable federal, state, and local requirements on equipment related to handling HFC-134a material. Safety precautions or notices related to safe operation of the equipment shall be prominently displayed on the equipment and should also state "CAUTION—SHOULD BE OPERATED BY QUALIFIED PERSONNEL".
- 5.2 HFC-134a has been shown to be nonflammable at ambient temperature and atmospheric pressure. However, tests under controlled conditions have indicated that, at pressures above atmospheric and with air concentrations greater than 60% by volume, HFC-134a can form combustible mixtures. While it is recognized that an ignition source is also required for combustion to occur, the presence of combustible mixtures is a potentially dangerous situation and should be avoided.
- 5.3 Under NO CIRCUMSTANCES should any equipment be pressure tested or leak tested with air/HFC-134a mixtures. Do not use compressed air (shop air) for leak detection in HFC-134a systems.

6. Operating Instructions

- 6.1 The equipment manufacturer must provide operating instructions, including proper attainment of vehicle system vacuum (*i.e.*, when to stop the extraction process), filter/desiccant replacement, and purging of noncondensable gases (air). Also to be included are any other necessary maintenance procedures, source information for replacement parts and repair, and safety precautions.

- 6.2 The equipment must prominently display the manufacturer's name, address, the type of refrigerant it is designed to recycle, a service telephone number, and the part number for the replacement filter/drier.

7. Functional Description

- 7.1 The equipment must be capable of ensuring removal of refrigerant from the system being serviced by reducing the system pressure to a minimum of 102 mm (4 in) of mercury below atmospheric pressure (i.e., vacuum).
- 7.2 During operation, the equipment shall provide overfill protection to assure that the liquid fill of the storage container (which may be integral or external) does not exceed 80% of the tank's rated volume at 21.1 °C (70 °F) per Department of Transportation (DOT) Standard, 49 CFR 173.304 and the American Society of Mechanical Engineers.
- 7.3 Portable refillable tanks or containers used in conjunction with this equipment must be labeled "HFC-134a", meet applicable DOT or Underwriters Laboratories (UL) Standards, and shall incorporate fittings per SAE J2197.
- 7.3.1 The cylinder valve shall comply with the standard for cylinder valves, UL 1769.
- 7.3.2 The pressure relief device shall comply with the Pressure Relief Device Standard Part 1—Cylinders for Compressed Gases, CGA Pamphlet S-1.1.
- 7.3.3 The tank assembly shall be marked to indicate the first retest date which shall be 5 years after the date of manufacture. The marking shall indicate that retest must be performed every subsequent 5 years. The marking shall be in letter at least 6 mm (¼ in) high.
- 7.4 All flexible hoses must comply with SAE J2196.
- 7.5 Service hoses must have shutoff devices located within 30 cm (12 in) of the connection point to the system being serviced as identified in J2196. All service fittings must comply with SAE J2197.
- 7.6 The equipment must be able to separate the lubricant from the removed refrigerant and accurately indicate the amount of lubricant removed during the process, in 30 mL (1 fl oz) units. Refrigerant dissolves in lubricants and, as a result, increases the volume of the recovered lubricant sample. This creates the illusion that more lubricant has been recovered than actually has been. The equipment lubricant measuring system must take into account such dissolved refrigerant to prevent overcharging the vehicle system with lubricant. (Note: Use only new lubricant to replace the amount removed during the recycling process. Used lubricant should be dis-

carded per applicable federal, state, and local requirements.)

8. Testing

This test procedure and its requirements are to be used to determine the ability of the recycling equipment to adequately recycle contaminated refrigerant.

- 8.1 The equipment shall be able to clean the contaminated refrigerant in section 8.3 to the purity level defined in SAE J2099.
- 8.2 The equipment shall be operated in accordance with the manufacturer's operating instructions.
- 8.3 Contaminated HFC-134a Sample.
- 8.3.1 The standard contaminated refrigerant shall consist of liquid HFC-134a with 1300 ppm (by weight) moisture (equivalent to saturation at 38 °C [100 °F]), 45,000 ppm (by weight) HFC-134a compatible lubricant, and 1000 ppm (by weight) of noncondensable gases (air).
- 8.3.1.1 The HFC-134a compatible lubricant referred to in section 8.3.1 shall be ICI DGLF 118, or equivalent, which shall contain no more than 1000 ppm by weight of moisture.
- 8.4 Test Cycle
- 8.4.1 The equipment must be preconditioned by processing 13.6 kg (30 lb) of the standard contaminated HFC-134a at an ambient of 21 °C (70 °F) before starting the test cycle. 1.13 kg (2.5 lb) samples are to be processed at 5 min intervals. The test fixture, depicted in Figure 1 to Appendix A, shall be operated at 21 °C (70 °F).
- 8.4.2 Following the preconditioning procedure per section 8.4.1, 18.2 kg (40 lb) of standard contaminated HFC-134a are to be processed by the equipment.
- 8.5 Sample Requirements
- 8.5.1 Samples of the standard contaminated refrigerant from section 8.3.1 shall be processed as required in section 8.6 and shall be analyzed after said processing as defined in sections 8.7, 8.8, and section 8.9. Note exception for non-condensable gas determination in section 8.9.4.
- 8.6 Equipment Operating Ambient
- 8.6.1 The HFC-134a is to be cleaned to the purity level, as defined in SAE J2099, with the equipment operating in a stable ambient of 10, 21, and 49 °C (50, 70, 120 °F) while processing the samples as defined in section 8.4.
- 8.7 Quantitative Determination of Moisture
- 8.7.1 The recycled liquid phase sample of HFC-134a shall be analyzed for moisture content via Karl Fischer coulometric titration, or an equivalent method. The Karl Fischer apparatus is an instrument for precise determination of small amounts of water dissolved in liquid and/or gas samples.

- 8.7.2 In conducting this test, a weighed sample of 30 to 130 g is vaporized directly into the Karl Fischer anolyte. A coulometric titration is conducted and the results are reported as parts per million moisture (weight).
- 8.8 Determination of Percent Lubricant
- 8.8.1 The amount of lubricant in the recycled HFC-134a sample shall be determined via gravimetric analysis. The methodology must account for the hygroscopicity of the lubricant.
- 8.8.2 Following venting of noncondensable gases in accordance with the manufacturer's operating instructions, the refrigerant container shall be shaken 5 min prior to extracting samples for testing.
- 8.8.3 A weighed sample of 175 to 225 g of liquid HFC-134a is allowed to evaporate at room temperature. The percent lubricant is calculated from weights of the original sample and the residue remaining after evaporation.
- 8.9 Noncondensable Gases
- 8.9.1 The amount of noncondensable gases shall be determined by gas chromatography. A sample of vaporized refrigerant liquid shall be separated and analyzed by gas chromatography. A Porapak Q column at 130 °C (266 °F) and a hot wire detector may be used for the analysis.
- 8.9.2 This test shall be conducted on liquid phase samples of recycled refrigerant taken from a full container as defined in section 7.2 within 30 minutes following the proper venting of noncondensable gases.
- 8.9.3 The liquid phase samples in section 8.9.2 shall be vaporized completely prior to gas chromatographic analysis.
- 8.9.4 This test shall be conducted at 21 and 49 °C (50 and 120 °F) and may be performed in conjunction with the testing defined in section 8.6. The equipment shall process at least 13.6 kg (30 lb) of standard contaminated refrigerant for this test).

Rationale

Not applicable.

Relationship of Standard to ISO Standard

Not applicable.

Application

The purpose of this standard is to establish the specific minimum equipment requirements for recycling HFC-134a that has been directly removed from, and is intended for reuse in, mobile air-conditioning (A/C) systems.

Reference Section

SAE J2099—Standard of Purity for Recycled HFC-134a for Use in Mobile Air-Conditioning Systems

SAE J2196—Service Hoses for Automotive Air-Conditioning
 SAE J2197—Service Hose Fittings for Automotive Air-Conditioning
 CGA Pamphlet S-1.1—Pressure Relief Device Standard Part 1—Cylinders for Compressed Gases
 UL 1769—Cylinder Valves
 UL 1963—Refrigerant Recovery/Recycling Equipment
 DOT Standard, 49 CFR 173.304—Shippers—General Requirements for Shipment and Packagings
 II. SAE J2211, issued December, 1991.

RECOMMENDED SERVICE PROCEDURE FOR THE CONTAINMENT OF HFC-134a

1. Scope

Refrigerant containment is an important part of servicing mobile air-conditioning systems. This procedure provides guidelines for technicians for servicing mobile air-conditioning systems and operating refrigerant recycling equipment designed for HFC-134a (described in SAE J2210).

2. References

- 2.1 Applicable Documents—The following publications form a part of this specification to the extent specified. The latest issue of SAE publications shall apply.
- 2.1.1 SAE Publications—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.
- SAE J2196—Service Hoses for Automotive Air-Conditioning
 SAE J2197—Service Hose Fittings for Automotive Air-Conditioning
 SAE J2210—Refrigerant Recycling Equipment for HFC-134a Mobile Air-Conditioning Systems
 SAE J2219—Concerns to the Mobile Air-Conditioning Industry
- 2.2 Definitions
- 2.2.1 Recovery/Recycling (R/R) Unit—Refers to a single piece of equipment that performs both functions of recovery and recycling of refrigerants per SAE J2210.
- 2.2.2 Recovery—Refers to that portion of the R/R unit operation that removes the refrigerant from the mobile air-conditioning system and places it in the R/R unit storage container.
- 2.2.3 Recycling—Refers to that portion of the R/R unit operation that processes the refrigerant for reuse on the same job site to the purity specifications of SAE J2099.

3. Service Procedure

- 3.1 Connect the recycling unit service hoses, which shall have shutoff devices (e.g., valves) within 30 cm (12 in) of the service ends, to the vehicle air-conditioning (A/C) service ports. Hoses shall

conform to SAE J2196 and fittings shall conform to SAE J2197.

- 3.2 Operate the recycling equipment per the equipment manufacturer's recommended procedure.
- 3.2.1 Verify that the vehicle A/C system has refrigerant pressure. Do not attempt to recycle refrigerant from a discharged system as this will introduce air (non-condensable gas) into the recycling equipment which must later be removed by purging.
- 3.2.2 Begin the recycling process by removing the refrigerant from the vehicle A/C system. Continue the process until the system pressure has been reduced to a minimum of 102mm (4 in) of mercury below atmospheric pressure (*i.e.*, vacuum). If A/C components show evidence of icing, the component can be gently heated to facilitate refrigerant removal. With the recycling unit shut off for at least 5 minutes, check A/C system pressure. If this pressure has risen above vacuum (0 psig), additional recycler operation is required to remove the remaining refrigerant. Repeat the operation until the system pressure remains stable at vacuum for 2 minutes.
- 3.3 Close the valves in the service lines and then remove the service lines from the vehicle system. If the recovery equipment has automatic closing valves, be sure they are operating properly. Proceed with the repair/service.
- 3.4 Upon completion of refrigerant removal from the A/C system, determine the amount of lubricant removed during the process and replenish the system with new lubricant, which is identified on the A/C system label. Used lubricant should be discarded per applicable federal, state, and local requirements.

4. Service With a Manifold Gauge Set

- 4.1 High-side, low-side, and center service hoses must have shutoff devices (*e.g.*, valves) within 30 cm (12 in) of the service ends. Valves must be closed prior to hose removal from the A/C system to prevent refrigerant loss to the atmosphere.
- 4.2 During all service operations, service hose valves should be closed until connected to the vehicle A/C system or to the charging source to exclude air and/or contain the refrigerant.
- 4.3 When the manifold gauge set is disconnected from the A/C system, or when the center hose is moved to another device

that cannot accept refrigerant pressure, the gauge set hoses should be attached to the recycling equipment to recover the refrigerant from the hoses.

5. Supplemental Refrigerant Checking Procedure for Stored Portable Containers

- 5.1 Certified recycling equipment and the accompanying recycling procedure, when properly followed, will deliver use-ready refrigerant. In the event that the full recycling procedure was not followed or the technician is unsure about the non-condensable gas content of a given tank of refrigerant, this procedure can be used to determine whether the recycled refrigerant container meets the specification for noncondensable gases (air). (Note: The use of refrigerant with excess air will result in higher system operating pressures and may cause A/C system damage.)
- 5.2 The container must be stored at a temperature of 18.3 °C (65 °F) or above for at least 12 hours, protected from direct sunlight.
- 5.3 Install a calibrated pressure gauge, with 6.9 kPa (1 psig) divisions, on the container and read container pressure.
- 5.4 With a calibrated thermometer, measure the air temperature within 10 cm (4 in) of the container surface.
- 5.5 Compare the observed container pressure and air temperature to the values given in Tables 1 and 2 to determine whether the container pressure is below the pressure limit given in the appropriate table. For example, at an air temperature of 21 °C (70 °F) the container pressure must not exceed 524 kPa (76 psig).
- 5.6 If the refrigerant in the container has been recycled and the container pressure is less than the limit in Tables 1 and 2, the refrigerant may be used.
- 5.7 If the refrigerant in the container has been recycled and the container pressure exceeds the limit in Tables 1 and 2, slowly vent, from the top of the container, a small amount of vapor into the recycle equipment until the pressure is less than the pressure shown in Tables 1 and 2.
- 5.8 If, after shaking the container and letting it stand for a few minutes, the container pressure still exceeds the pressure limit shown in Tables 1 and 2, the entire contents of the container shall be recycled.

TABLE 1—MAXIMUM ALLOWABLE CONTAINER PRESSURE (METRIC)

Temp, C(F)	kPa	Temp, C(F)	kPa	Temp, C(F)	kPa	Temp, C(F)	kPa
18 (65)	476	26 (79)	621	34 (93)	793	42 (108)	1007
19 (66)	483	27 (81)	642	35 (95)	814	43 (109)	1027
20 (68)	503	28 (82)	655	36 (97)	841	44 (111)	1055
21 (70)	524	29 (84)	676	37 (99)	876	45 (113)	1089

TABLE 1—MAXIMUM ALLOWABLE CONTAINER PRESSURE (METRIC)—Continued

Temp, C(F)	kPa	Temp, C(F)	kPa	Temp, C(F)	kPa	Temp, C(F)	kPa
22 (72)	545	30 (86)	703	38 (100)	889	46 (115)	1124
23 (73)	552	31 (88)	724	39 (102)	917	47 (117)	1158
24 (75)	572	32 (90)	752	40 (104)	945	48 (118)	1179
25 (77)	593	33 (91)	765	41 (106)	979	49 (120)	1214

TABLE 2—MAXIMUM ALLOWABLE CONTAINER PRESSURE (ENGLISH)

Temp, F	psig	Temp, F	psig	Temp, F	psig	Temp, F	psig
65	69	79	90	93	115	107	144
66	70	80	91	94	117	108	146
67	71	81	93	95	118	109	149
68	73	82	95	96	120	110	151
69	74	83	96	97	122	111	153
70	76	84	98	98	125	112	156
71	77	85	100	99	127	113	158
72	79	86	102	100	129	114	160
73	80	87	103	101	131	115	163
74	82	88	105	102	133	116	165
75	83	89	107	103	135	117	168
76	85	90	109	104	137	118	171
77	86	91	111	105	139	119	173
78	88	92	113	106	142	120	176

6. Containers for Storage of Recycled Refrigerant

- 6.1 Recycled refrigerant should not be salvaged or stored in disposable containers (this is one common type of container in which new refrigerant is sold). Use only DOT 49 CFR or UL approved storage containers, specifically marked for HFC-134a, for recycled refrigerant.
- 6.2 Any container of recycled refrigerant that has been stored or transferred must be checked prior to use as defined in Section 5.
- 6.3 Evacuate the tanks to at least 635 mm Hg (25 in Hg) below atmospheric pressure (vacuum) prior to first use.

7. Transfer of Recycled Refrigerant

- 7.1 When external portable containers are used for transfer, the container must be evacuated to at least 635 mm (25 in Hg) below atmospheric pressure (vacuum) prior to transfer of the recycled refrigerant to the container. External portable containers must meet DOT and UL standards.
- 7.2 To prevent on-site overfilling when transferring to external containers, the safe filling level must be controlled by weight and must not exceed 60% of the container gross weight rating.

8. Safety Note for HFC-134a

- 8.1 HFC-134a has been shown to be nonflammable at ambient temperature and at-

mospheric pressure. However, recent tests under controlled conditions have indicated that, at pressures above atmospheric and with air concentrations greater than 60% by volume, HFC-134a can form combustible mixtures. While it is recognized that an ignition source is also required for combustion to occur, the presence of combustible mixtures is a potentially dangerous situation and should be avoided.

- 8.2 Under NO CIRCUMSTANCE should any equipment be pressure tested or leak tested with air/HFC-134a mixtures. Do not use compressed air (shop air) for leak detection in HFC-134a systems.

9. Disposal of Empty/Near Empty Containers

- 9.1 Since all refrigerant may not have been removed from disposable refrigerant containers during normal system charging procedures, empty/near empty container contents should be recycled prior to disposal of the container.
- 9.2 Attach the container to the recycling unit and remove the remaining refrigerant. When the container has been reduced from a pressure to vacuum, the container valve can be closed and the container can be removed from the unit. The container should be marked "Empty", after which it is ready for disposal.

III. SAE J2099, issued December, 1991.

Pt. 82, Subpt. B, App. D

STANDARD OF PURITY FOR RECYCLED HFC-134a FOR USE IN MOBILE AIR CONDITIONING SYSTEMS

Foreword

The purpose of this standard is to establish the minimum level of purity required for recycled HFC-134a removed from, and intended for reuse in, mobile air-conditioning systems.

1. Scope

This standard applies to HFC-134a refrigerant used to service motor vehicle passenger compartment air-conditioning systems designed or retrofitted to use HFC-134a. Hermetically sealed, refrigerated cargo systems are not covered by this standard.

2. References

- 2.1 Applicable Documents—The following publications form a part of this specification to the extent specified. The latest issue of SAE publications shall apply.
- 2.1.1 SAE publications—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.
 - SAE J2210—HFC-134a Recycling Equipment for Mobile Air-Conditioning Systems
 - SAE J2211—Recommended Service Procedure for the Containment of HFC-134a

3. Purity Specification

The refrigerant referred to in this standard shall have been directly removed from, and intended to be returned to, a mobile air-conditioning system. Contaminants in this recycled refrigerant shall be limited to moisture, refrigerant system lubricant, and non-condensable gases, which, when measured in the refrigerant liquid phase, shall not exceed the following levels:

- 3.1 Moisture—50 ppm by weight
 - 3.2 Lubricant—500 ppm by weight
 - 3.3 Noncondensable Gases (Air)—150 ppm by weight
- 4. Requirements for Recycle Equipment Used in Direct Mobile Air-Conditioning Service Operations**
- 4.1 Such equipment shall meet J2210, which covers additional moisture, acid, and filter requirements.

5. Operation of the Recycle Equipment

Recycle equipment operation shall be in accord with SAE J2211.

Application

This Standard applies to HFC-134a refrigerant used to service motor vehicle passenger compartment air-conditioning systems designed or retrofitted to use HFC-134a.

40 CFR Ch. I (7-1-00 Edition)

Hermetically sealed, refrigerated cargo systems are not covered by this standard.

Reference Section

- SAE J2210—HFC-134a Recycling Equipment for Mobile Air-Conditioning Systems
- SAE J2211—Recommended Service Procedure for the Containment of HFC-134a.

[62 FR 68048, Dec. 30, 1997]

APPENDIX D TO SUBPART B OF PART 82—STANDARD FOR HFC-134a RECOVER-ONLY EQUIPMENT

SAE J2211, Recommended Service Procedure for Containment of HFC-134a, as set forth under Appendix C of this subpart, also applies to this Appendix D
SAE J1732, issued December, 1994.

HFC-134a (R-134a) EXTRACTION EQUIPMENT FOR MOBILE AUTOMOTIVE AIR-CONDITIONING SYSTEMS

Foreword

Appendix C established equipment specifications for on-site recovery and reuse of HFC-134a in air-conditioning systems. These specifications are for HFC-134a extraction only equipment that are intended to be used in conjunction with the on-site recycling equipment currently used at service facilities, or allow for off-site refrigerant reclamation.

1. Scope

The purpose of this standard is to provide equipment specification for only the recovery of HFC-134a refrigerant to be returned to a refrigerant reclamation facility that will process it to ARI Standard 700-93 or allow for recycling of the recovered refrigerant to SAE J2210 specifications by using Design Certified equipment of the same ownership. It is not acceptable that refrigerant removed from a mobile air conditioning system with this equipment be directly returned to a mobile air-conditioning system.

This information applies to equipment used to service automobiles, light trucks, and other vehicles with similar HFC-134a air conditioning systems.

2. References

- 2.1 Applicable Documents—The following publications form a part of this specification to the extent specified.
- 2.1.1 SAE Publications—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.
 - SAE J639—Vehicle Service Coupling
 - SAE J2210—HFC-134a Recycling Equipment for Mobile Automotive Air Conditioning Systems
 - SAE J2196—Service Hoses for Automotive Air-Conditioning

SAE J2197—Service Hose Fittings for Automotive Air-Conditioning

2.1.2 ARI Publication—Available from Air Conditioning and Refrigerant Institute, 1501 Wilson Blvd. Sixth Floor, Arlington, VA 22209.

ARI 700-93—Specifications for Fluorocarbon Refrigerants

2.1.3 CGA Publications—Available from CGA, 1235 Jefferson Davis Highway, Arlington, VA 22202.

CGA Pamphlet S-1.1—Pressure Relief Device Standard

Part 1—Cylinders for Compressed Gases

2.1.4 DOT Publications—Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

DOT Standard, 49 CFR 49 173.304—Shippers-General Requirements for Shipments and Packagings

2.1.5 UL Publications—Available from Underwriters Laboratories, 333 Pfingsten Road, Northbrook, IL 60062-2096.

UL 1769—Cylinder Valves

3. Specification and General Description

- 3.1 The equipment must be able to extract HFC-134a from a mobile air-conditioning system.
- 3.2 The equipment shall be suitable for use in an automotive service garage environment as defined in section 6.8.
- 3.3 Equipment Certification—The equipment shall be certified by Underwriters Laboratories or an equivalent certifying laboratory to meet this standard.
- 3.4 Label Requirements—The equipment shall have a label “Design Certified by (Company Name) to meet SAE J1732 for use only with HFC-134a. The refrigerant from this equipment must be processed to ARI 700-93 specifications or to SAE J2210 specifications by using Design Certified equipment of the same ownership.” The minimum letter size shall be bold type 3 mm in height.

4. Safety Requirements

- 4.1 The equipment must comply with applicable federal, state, and local requirements on equipment related to the handling of HFC-134a material. Safety precautions or notices or labels related to the safe operation of the equipment shall also be prominently displayed on the equipment and should state “CAUTION—SHOULD BE OPERATED BY CERTIFIED PERSONNEL.” The safety identification shall be located on the front near the controls.
- 4.2 The equipment must comply with applicable safety standards for electrical and mechanical requirements.

5. Operating Instructions

- 5.1 The equipment manufacturer must provide operating instructions that include information required by SAE J1629, necessary maintenance procedures, and source information for replacement parts and repair.
 - 5.1.1 The instruction manual shall include the following information on the lubricant removed. Only new lubricant, as identified by the system manufacturer, should be replaced in the mobile air conditioning system. Removed lubricant from the system and/or the equipment shall be disposed of in accordance with the applicable federal, state, and local procedures and regulations.
- 5.2 The equipment must prominently display the manufacturer's name, address, the type of refrigerant it is designed to extract, a service telephone number, and any items that require maintenance or replacement that affect the proper operation of the equipment. Operation manuals must cover information for complete maintenance of the equipment to assure proper operation.

6. Functional Description

- 6.1 The equipment must be capable of ensuring removal of refrigerant from the system being serviced by reducing the system pressure to a minimum of 102 mm (4 in) of mercury below atmospheric pressure (*i.e.*, vacuum). To prevent system delayed outgassing, the unit must have a device that assures the refrigerant has been recovered from the air-conditioning system.
 - 6.1.1 Testing laboratory certification of the equipment capability is required which shall process contaminated refrigerant samples at specific temperatures.
- 6.2 The equipment must be preconditioned by processing 13.6 kg (30 lb) of the standard contaminated HFC-134a at an ambient of 21 °C (70 °F) before starting the test cycle. Sample amounts are not to exceed 1.13 kg (2.5 lb) with sample amounts to be repeated every 5 minutes. The test fixture shown in Figure 1 to Appendix A of this subpart shall be operated at 21 °C. Contaminated HFC-134a samples shall be processed at ambient temperatures of 10 and 49 °C, without equipment shutting due to any safety devices employed in this equipment.
 - 6.2.1 Contaminated HFC-134a sample
 - 6.2.2 Standard contaminated HFC-134a refrigerant, 13.6 kg sample size, shall consist of liquid HFC-134a with 1300 ppm (by weight) moisture at 21 °C and 45,000 ppm (by weight) of oil (polyalkylene glycol oil with 100 cs viscosity at 40 °C or equivalent) and 1000 ppm by weight of non-condensable gases (air).

- 6.3 Portable refillable containers used in conjunction with this equipment must meet applicable DOT Standards.
- 6.3.1 The container color must be blue with a yellow top to identify that it contains used HFC-134a refrigerant. It must be permanently marked on the outside surface in black print at least 20 mm high "DIRTY HFC-134a—DO NOT USE, MUST BE REPROCESSED".
- 6.3.2 The portable refillable container shall have a ½ inch ACME thread.
- 6.3.3 During operation, the equipment shall provide overfill protection to assure that the storage container liquid fill does not exceed 80% of the tank's rated volume at 21 °C per DOT Standard, 49 CFR 173.304 and the American Society of Mechanical Engineers.
- 6.4 Additional Storage Tank Requirements
- 6.4.1 The cylinder valve shall comply with UL 1769.
- 6.4.2 The pressure relief device shall comply with CGA Pamphlet S-1.1.
- 6.4.3 The container assembly shall be marked to indicate the first retest date, which shall be 5 years after date of manufacture. The marking shall indicate that retest must be performed every subsequent 5 years. The markings shall be in letters at least 6 mm high.
- 6.5 All flexible hoses must meet SAE J2196 for service hoses.
- 6.6 Service hoses must have shutoff devices located within 30 cm (12 in) of the connection point to the system being serviced to minimize introduction of non-condensable gases into the recovery equipment during connection and the release of the refrigerant during disconnection.
- 6.7 The equipment must be able to separate the lubricant from recovered refrigerant and accurately indicate the amount removed from the simulated automotive system during processing in 30 mL units.
- 6.7.1 The purpose of indicating the amount of lubricant removed is to ensure that a proper amount of new lubricant is returned to the mobile air conditioning system for compressor lubrication.
- 6.7.2 Refrigerant dissolved in this lubricant must be accounted for to prevent system lubricant overcharge of the mobile air-conditioning system.
- 6.8 The equipment must be capable of continuous operation in ambient temperatures of 10 °C to 49 °C and comply with 6.1 and 6.2.
7. For test validation, the equipment is to be operated according to the manufacturer's instructions.

Application

The purpose of this standard is to provide equipment specification for only the recovery

of HFC-134a refrigerant to be returned to a refrigerant reclamation facility that will process it to ARI Standard 700-93 or allow for the recycling of the recovered refrigerant to SAE J2210 specifications by using Design Certified equipment of the same ownership. It is not acceptable that the refrigerant removed from a mobile air-conditioning system with this equipment be directly returned to a mobile air-conditioning system.

This information applies to equipment used to service automobiles, light trucks, and other vehicles with similar HFC-134a air-conditioning systems.

Reference Section

SAE J639—Vehicle Service Coupling
 SAE J2210—HFC-134a Recycling Equipment for Mobile Automotive Air Conditioning Systems
 SAE J2196—Service Hoses for Automotive Air-Conditioning
 ARI 700-93—Specifications for Fluorocarbon Refrigerants
 CGA Pamphlet S-1.1—Pressure Relief Device Standard Part 1—Cylinders for Compressed Gases
 UL 1769—Cylinder Valves
 49 CFR 173.304—Shippers—General Requirements for Shipment and Packagings

[62 FR 68052, Dec. 30, 1997]

APPENDIX E TO SUBPART B OF PART 82— THE STANDARD FOR AUTOMOTIVE REFRIGERANT RECYCLING EQUIPMENT INTENDED FOR USE WITH BOTH CFC-12 AND HFC-134A

SAE J2211, Recommended Service Procedure for the Containment of HFC-134a, as set forth under Appendix C of this subpart, and SAE J1989, Recommended Service Procedure for the Containment of CFC-12, as set forth under Appendix A of this subpart, also apply to this Appendix E of this subpart.

SAE J1770, issued December, 1995.

AUTOMOTIVE REFRIGERANT RECYCLE EQUIPMENT INTENDED FOR USE WITH BOTH CFC-12 AND HFC-134a

Foreword

The purpose of this standard is to establish specific minimum equipment requirements for automotive refrigerant recycling equipment intended for use with both CFC-12 and HFC-134a in a common refrigerant circuit. Establishing such specifications will assure that this equipment does not cross contaminate refrigerant above specified limits when used under normal operating conditions.

1. Scope

The purpose of this standard is to establish the specific minimum equipment intended for use with both CFC-12 and HFC-134a in a

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common refrigerant circuit that has been directly removed from, and is intended for reuse in, mobile air-conditioning (A/C) systems. This standard does not apply to equipment used for CFC-12 and HFC-134a having a common enclosure with separate circuits for each refrigerant.

2. References

- 2.1 Applicable Documents—The following publications form a part of this specification to the extent specified. The latest issue of SAE publications shall apply.
 - 2.1.1 SAE Publications—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.
 - SAE J2099—Standard of Purity for Recycled HFC-134a for Use in Mobile Air-Conditioning Systems
 - SAE 1991—Standard of Purity for Use in Mobile Air-Conditioning Systems
 - SAE J2196—Service Hoses for Automotive Air-Conditioning
 - SAE J2197—Service Hose Fittings for Automotive Air-Conditioning
 - SAE J2210—HFC-134a (R-134a) Recycling Equipment for Mobile A/C Systems
 - SAE J1990—Extraction and Recycling Equipment for Mobile A/C Systems
 - 2.1.2 Compressed Gas Association (CGA) Publications—Available from CGA, 1235 Jefferson Davis Highway, Arlington, VA 22202.
 - CGA Pamphlet S-1.1—Pressure Relief Device Standard
 - Part 1—Cylinders for Compressed Gases
 - 2.1.3 DOT Publications—Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
 - 2.1.4 UL Publications—Available from Underwriters Laboratories, 333 Pfingsten Road, Northbrook, IL 60062-2096.
 - UL 1769—Cylinder Valves
 - UL 1963—Refrigerant Recovery/Recycling Equipment

3. Specification and General Description

- 3.1 The equipment shall be suitable for use in an automotive service garage environment and be capable of continuous operation in ambients from 10 to 49 °C.
- 3.2 The equipment must be certified that it meets this specification by Underwriters Laboratories Inc. (UL), or by an equivalent Nationally Recognized Testing Laboratory (NRTL).
- 3.3 The equipment shall have a label which states "Design Certified by (Certifying Agent) to meet SAE J1770 for recycling CFC-12 and HFC-134a using common refrigerant circuits", in bold-type letters a minimum of 3 mm in height.

4. Equipment Requirements

4.1 General

4.1.1 The equipment shall be capable of preventing cross contamination to the level required by Section 9.2.1.G before an operation involving a different refrigerant can begin. The equipment must prevent initiation of the recovery operation if the equipment is not set up properly.

4.1.2 If an operator action is required to clear the unit prior to reconnecting for a different refrigerant, the equipment shall be provided with a means which indicates which refrigerant was last processed.

4.1.3 Means shall be provided to prevent recovery from both an CFC-12 and HFC-134a mobile air conditioning system concurrently.

4.1.4 Transfer of recycled refrigerant—Recycled refrigerant for recharging and transfer shall be taken from the liquid phase only.

4.2 Seat Leakage Test

4.2.1 Valves, including electrically operated solenoid valves, that are used to isolate CFC-12 and HFC-134a refrigerant circuits, shall have a seat leakage rate not exceeding 15 g/yr (½ oz/yr) before and after 100,000 cycles of operation. This Endurance Test shall be conducted with HFC-134a at maximum operating pressure as determined by sections 8.1 and 8.2. The Seat Leakage Test shall be performed at 1.5 times this pressure at an ambient of 24 °C.

4.3 Interlocks

4.3.1 Electrical interlock devices used to prevent cross contamination of refrigerant shall be operated for 100,000 cycles and there shall be no failure that would permit cross contamination of refrigerant. Solid state inter lock devices shall comply with the Transient Overvoltage Test and the Fast Transient (Electric Noise) Test contained in the Standard for Tests for Safety Related Controls Employing Solid-State Devices, UL 991.

4.4 Noncondensable Gases

4.4.1 The equipment shall either automatically purge noncondensables (NCGs) if the acceptable level is exceeded or incorporate a device that indicates to the operator the NCG level has been exceeded. A pressure gauge used to indicate an NCG level shall be readable in 1 psig increments. NCG removal must be part of the normal operation of the equipment and instructions must be provided to enable the task to be accomplished within 30 minutes.

4.4.2 Refrigerant loss from noncondensable gas purging, oil removal, and refrigerant clearing shall not exceed more than 5 percent by weight of the total amount of refrigerant through the equipment as detailed in Sections 8.1, 8.2, and 9.2.

4.5 Filter

4.5.1 A 15 micron filter, or other equivalent means, to remove particulates of 15 micrometers spherical diameter or greater shall be located before any manual electrically operated valves that may cause cross contamination.

4.6 Moisture and Acid

4.6.1 The equipment shall incorporate a desiccant package that must be replaced before saturated with moisture, and whose acid capacity is at least 5% by weight of the dry desiccant.

4.6.2 The equipment shall be provided with a moisture detection means that will reliably indicate when moisture in the HFC-134a exceeds 50 ppm, or in the CFC-12 exceeds 15 ppm, and requires the filter/drier replacement.

5. Operating Instructions

5.1 The equipment manufacturer must provide operating instructions, including proper attainment of vehicle system vacuum (*i.e.*, when to stop the extraction process, and also to stop the extraction process if it is noticed that the A/C system being serviced has a leak), filter/desiccant replacement, and purging of non-condensable gases (air). The instructions shall indicate that the correct sequence of operation be followed so that the equipment can properly remove contaminants to the acceptable level. Also to be included are any other necessary maintenance procedures, source information for replacement parts and repair, and safety precautions.

5.2 The equipment must prominently display the manufacturer's name, address, the type of refrigerant (CFC-12 and HFC-134a), a service telephone number, and the part number for the replacement filter/drier. Operation manuals must cover information for complete maintenance of the equipment to assure proper operation.

6. Safety Requirements

6.1 The equipment must comply with applicable federal, state, and local requirements on equipment related to handling CFC-12 and HFC-134a material. Safety precautions or notices related to the safe operation of the equipment shall be prominently displayed on the equipment and should also state "CAUTION—SHOULD BE OPERATED BY QUALIFIED PERSONNEL".

6.2 HFC-134a has been shown to be nonflammable at ambient temperature and atmospheric pressure. The following statement shall be in the operating manual: "Caution: HFC-134a service equipment or vehicle A/C systems should not be pressure tested or leak tested with compressed air. Some mixtures of air and

HFC-134a have been shown to be combustible at elevated pressures (when contained in a pipe or tank). These mixtures may be potentially dangerous, causing injury or property damage. Additional health and safety information may be obtained from refrigerant and lubricant manufacturers."

7. Functional Description

7.1 General

7.1.1 The equipment must be capable of ensuring recovery of the CFC-12 and HFC-134a from the system being serviced, by reducing the system to a minimum of 102 mm of mercury below atmospheric pressure (*i.e.*, vacuum).

7.1.2 The equipment must be compatible with leak detection material that may be present in the mobile A/C system.

7.2 Shut Off Device

7.2.1 To prevent overcharge, the equipment must be equipped to protect the tank used to store the recycled refrigerant with a shutoff device and a mechanical pressure relief valve.

7.3 Storage Tanks

7.3.1 Portable refillable tanks or containers shall be supplied with this equipment and must be labeled "HFC-134a" or "CFC-12" as appropriate, meet applicable Department of Transportation (DOT) or NRTL's Standards and be adaptable to existing refrigerant service and charging equipment.

7.3.2 The cylinder valve shall comply with the Standard for Cylinder Valves, UL 1769.

7.3.3 The pressure relief device shall comply with the Pressure Relief Device Standard Part 1—Cylinders for Compressed Gases, CGA Pamphlet S-1.1.

7.3.4 The tank assembly shall be marked to indicate the first retest date, which shall be 5 years after the date of manufacture. The marking shall indicate that retest must be performed every subsequent 5 years. The marking shall be in letters at least 6 mm high.

7.4 Overfill Protection

7.4.1 During operation, the equipment must provide overfill protection to assure that during filling or transfer, the tank or storage container cannot exceed 80% of volume at 21.1 °C of its maximum rating as defined by DOT standards, 49 CFR 173.304 and American Society of Mechanical Engineers.

7.5 Hoses and Connections

7.5.1 Separate inlet and outlet hoses with fittings and separate connections shall be provided for each refrigerant circuit.

7.5.2 All flexible hoses and fittings must meet SAE J2196 (for CFC-12) and SAE J2197 (for HFC-134a).

7.5.3 Service hoses must have shutoff devices located within 30 cm of the connection point to the system being serviced.

7.6 Lubricant Separation

7.6.1 The equipment must be able to separate the lubricant from the removed refrigerant and accurately indicate the amount of lubricant removed during the process, in 30 mL (1 fl oz) units. Refrigerant dissolves in lubricant and, as a result, increases the volume of the recovered lubricant sample. This creates the illusion that more lubricant has been recovered than actually has been. The equipment lubricant measuring system must take into account such dissolved refrigerant removed from the A/C system being serviced to prevent overcharging the vehicle system with lubricant.

(NOTE: Use only new lubricant to replace the amount removed the recycling process. Used lubricant should be discarded per applicable federal, state and local requirements.)

7.6.2 The equipment must be provided with some means, such as a lockout device, which will prevent initiation of the recovery operation after switching to the other refrigerant, if the lubricant has not been drained from the oil separator.

8. Testing

8.0 Equipment shall be tested in sequence as noted in sections 8.1, 8.2 and 9.2. The filter/drier may be replaced only as noted by section 4.6.2.

8.1 CFC-12 Recycling Cycle

8.1.1 The maximum operating pressure of the equipment shall be determined when recycling CFC-12 while conducting the following tests. This pressure is needed for the Seat Leakage Test, Section 4.2.

8.1.2 The equipment must be preconditioned with 13.6 kg of the standard contaminated CFC-12 (see section 8.1.2a) at an ambient of 21 °C before starting the test cycle. Sample amounts shall be 1.13 kg with sample amounts to be repeated every 5 minutes. The sample method fixture, defined in Figure 1 to Appendix A, shall be operated at 21 °C.

8.1.2a Standard contaminated CFC-12 refrigerant shall consist of liquid CFC-12 with 100 ppm (by weight) moisture at 21°C and 45,000 ppm (by weight) mineral oil 525 suspension viscosity nominal and 770 ppm by weight of noncondensable gases (air).

8.1.3 The high moisture contaminated sample shall consist of CFC-12 vapor with 1000 ppm (by weight) moisture.

8.1.4 The high oil contaminated sample shall consist of CFC-12 with 200,000 ppm (by weight) mineral oil 525 suspension viscosity nominal.

8.1.5 After preconditioning as stated in section 8.1.2, the test cycle is started,

processing the following contaminated samples through the equipment.

A. 13.6 kg (1.13 kg per batch) of standard contaminated CFC-12.

B. 1 kg of high oil contaminated CFC-12.

C. 4.5 kg (1.13 kg per batch) of standard contaminated CFC-12.

D. 1 kg of high moisture contaminated CFC-12.

8.1.6 The CFC-12 is to be cleaned to the minimum purity level, as defined in SAE J1991, with the equipment operating in a stable ambient of 10, 21, and 49°C and processing the samples as defined in section 8.1.5.

8.2 HFC-134a Recycling Cycle

8.2.1 The maximum operating pressure of the equipment shall be determined when recycling HFC-134a while conducting the following tests. This pressure is needed for the Seat Leakage Test, Section 4.2.

8.2.2 The equipment must be preconditioned by processing 13.6 kg of the standard contaminated HFC-134a (see section 8.2.2a) at an ambient of 21 °C before starting the test cycle. 1.13 kg samples are to be processed at 5 minute intervals. The test fixture shown in Figure 1 to Appendix A shall be operated at 21 °C.

8.2.2a The standard contaminated refrigerant shall consist of liquid HFC-134a with 1300 ppm (by weight) moisture (equivalent to saturation at 38°[100 °F]), 45,000 ppm (by weight) HFC-134a compatible lubricant, and 1000 ppm (by weight) of noncondensable gases (air).

8.2.2b The HFC-134a compatible lubricant referred to in section 8.2.2a shall be a polyalkylene glycol based synthetic lubricant or equivalent, which shall contain no more than 1000 ppm by weight of moisture.

8.2.3 Following the preconditioning procedure per section 8.2.2, 18.2 kg of standard contaminated HFC-134a are to be processed by the equipment at each stable ambient temperature of 10, 21, and 49 °C.

8.2.4 The HFC-134a is to be cleaned to the purity level, as defined in SAE J2099.

9. Refrigerant Cross Contamination Test

9.1 General

9.1.1 For test validation, the equipment is to be operated according to the manufacturer's instruction.

9.1.2 The equipment shall clean the contaminated CFC-12 refrigerant to the minimum purity level as defined in Appendix A, when tested in accordance with the requirements in section 8.1.

9.1.3 The equipment shall clean the contaminated HFC-134a refrigerant to the purity level defined in Appendix C, when tested in accordance with the requirements in section 8.2.

9.2 Test Cycle

9.2.1 The following method shall be used after the tests and requirements in Sections 8.1 and 8.2, respectively, are completed. Following the manufacturer's instructions, the equipment shall be cleared of HFC-134a, prior to beginning step A. The only refrigerant used for this is noted in steps A, C, and E of section 9.2.1. The test fixture shown in Figure 1 to Appendix A shall be used and the test shall be conducted at 10, 21, and 49 °C ambients.

- A. A 1.13 kg standard contaminated sample of CFC-12 (see section 8.1.2a) shall be processed by the equipment.
- B. Follow manufacturer's instructions to clear the equipment of CFC-12 before processing HFC-134a.
- C. Process a 1.13 kg, standard contaminated sample of HFC-134a (see section 8.2.2a) through the equipment.
- D. Follow manufacturer's instructions to clear the equipment of HFC-134a before processing CFC-12.
- E. Process a 1.13 kg standard contaminated sample of CFC-12 (see section 8.1.2a) through the equipment.
- F. Follow manufacturer's instructions to clear the equipment of CFC-12.
- G. The amount of cross contaminated refrigerant, as determined by gas chromatography, in samples processed during steps C and E of section 9.2.1., shall not exceed 0.5 percent by weight.

10. Sample Analysis

10.1 General

10.1.1 The processed contaminated samples shall be analyzed according to the following procedure.

10.2 Quantitative Determination of Moisture

10.2.1 The recycled liquid phase sample of refrigerant shall be analyzed for moisture content via Karl Fischer coulometer titration or an equivalent method. The Karl Fischer apparatus is an instrument for precise determination of small amounts of water dissolved in liquid and/or gas samples.

10.2.2 In conducting the test, a weighed sample of 30 to 130 g is vaporized directly into the Karl Fischer anolyte. A coulometer titration is conducted and the results are calculated and displayed as parts per million moisture (weight).

10.3 Determination of Percent Lubricant

10.3.1 The amount of lubricant in the recycled sample of refrigerant/lubricant is to be determined by gravimetric analysis.

10.3.2 Following venting of noncondensable, in accordance with the manufacturer's operating instructions, the refrigerant container shall be shaken for 5 minutes prior to extracting samples for test.

10.3.3 A weighed sample of 175 to 225 g of liquid refrigerant/lubricant is allowed to evaporate at room temperature. The percent lubricant is to be calculated from the weight of the original sample and the residue remaining after the evaporation.

10.4 Noncondensable Gas

10.4.1 The amount of noncondensable gas is to be determined by gas chromatography. A sample of vaporized refrigerant liquid shall be separated and analyzed by gas chromatography. A Propak Q column at 130 °C and a hot wire detector may be used for analysis.

10.4.2 This test shall be conducted on liquid phase samples of recycled refrigerant taken from a full container as defined in 7.4 within 30 minutes following the proper venting of noncondensable gases.

10.4.3 The samples shall be shaken for at least 15 minutes prior to testing while at a temperature of 24 °C ± 2.8° C.

10.5 Refrigerant Cross Contamination

10.5.1 The amount of cross contamination of CFC-12 in HFC-134a or HFC-134a in CFC-12 shall not exceed 0.5 percent by weight as determined by gas chromatography. A sample of vaporized refrigerant liquid shall be separated and analyzed by gas chromatography. A 1% SP-1000 on Carbopack B (60/80 mesh) column may be used for the analysis.

[62 FR 68053, Dec. 30, 1997]

APPENDIX F TO SUBPART B OF PART 82— STANDARD FOR RECOVER-ONLY EQUIPMENT THAT EXTRACTS A SINGLE, SPECIFIC REFRIGERANT OTHER THAN CFC-12 OR HFC-134A

Foreword

These specifications are for equipment that recover, but does not recycle, any single, specific automotive refrigerant other than CFC-12 or HFC-134a, including a blend refrigerant.

1. Scope

The purpose of this standard is to provide equipment specifications for the recovery of any single, specific refrigerant other than CFC-12 or HFC-134a, including a blend refrigerant, which are either (1) to be returned to a refrigerant reclamation facility that will process the refrigerant to ARI Standard 700-93 or equivalent new product specifications at a minimum, or (2) to be recycled in approved refrigerant recycling equipment, or (3) to be destroyed. This standard applies to equipment used to service automobiles, light trucks, and other vehicles with similar air conditioning systems.

2. References

- 2.1 Applicable Documents—The following publications form a part of this specification to the extent specified. The latest issue of SAE publications shall apply.
- 2.1.1 SAE Publications—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001. SAE J639—Vehicle Service Coupling. SAE J2196—Service Hoses for Automotive Air-Conditioning (fittings modified)
- 2.1.2 ARI Publication—Available from Air Conditioning and Refrigeration Institute, 1501 Wilson Boulevard, Sixth Floor, Arlington, VA 22209. ARI 700-93—Specifications for Fluorocarbon Refrigerants.
- 2.1.3 Compressed Gas Association (CGA) Publications—Available from CGA, 1235 Jefferson Davis Highway, Arlington, VA 22202. CGA Pamphlet S-1.1—Pressure Relief Device Standard Part 1—Cylinders for Compressed Gases.
- 2.1.4 DOT Publications—Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.
- DOT Standard, 49 CFR 173.304—Shippers—General Requirements for Shipments and Packagings.
- 2.1.5 UL Publications—Available from Underwriters Laboratories, 333 Pfingsten Road, Northbrook, IL 60062-2096.
- UL 1769—Cylinder Valves.
- UL 1963—Refrigerant Recovery Recycling Equipment.

3. Specifications and General Description

- 3.1 The equipment must be able to extract from a mobile air conditioning system the refrigerant other than CFC-12 or HFC-134a to which the equipment is dedicated.
- 3.2 The equipment shall be suitable for use in an automotive service garage environment as defined in section 6.8.
- 3.3 The equipment discharge or transfer fitting shall be unique to prevent the unintentional use of the extracted refrigerant for recharging auto air conditioners.
- 3.4 Equipment Certification—The equipment shall be certified by Underwriters Laboratories or an equivalent certifying laboratory to meet this standard.
- 3.5 Label Requirements—The equipment shall have a label “Designed Certified by (Company Name) to meet EPA requirements for use only with (the applicable refrigerant). The refrigerant from this equipment must be processed to ARI 700-93 specifications or equivalent new product specifications before reuse in a mobile air-conditioning system.” The minimum letter size shall be bold type 3 mm in height.

4. Safety Requirements

- 4.1 The equipment must comply with applicable federal, state, and local requirements on equipment related to the handling of the applicable refrigerant material. Safety precautions or notices or labels related to the safe operation of the equipment shall also be prominently displayed on the equipment and should state “CAUTION—SHOULD BE OPERATED BY CERTIFIED PERSONNEL.” The safety identification shall be located on the front near the controls.
- 4.2 The equipment must comply with applicable safety standards for electrical and mechanical requirements.

5. Operating Instructions

- 5.1 The equipment manufacturer must provide operating instructions that include information equivalent to that required by SAE J1629, necessary maintenance procedures, and source information for replacement parts and repair.
- 5.1.1 The instruction manual shall include the following information on the lubricant removed: Only new lubricant, as identified by the system manufacturer, should be replaced in the air conditioning system. Removed lubricant from the system and/or the equipment shall be disposed on in accordance with the applicable federal, state, and local procedures and regulations.
- 5.2 The equipment must prominently display the manufacturer's name, address, the type of refrigerant it is designed to extract, a service telephone number, and any items that require maintenance or replacement that affect the proper operation of the equipment. Operation manuals must cover information for complete maintenance of the equipment to assure proper operation.

6.1 Functional Description

- 6.1 The equipment must be capable of ensuring removal of refrigerant from the system being serviced by reducing the system pressure to a minimum of 102 mm (4 in) of mercury below atmospheric pressure (*i.e.*, to a vacuum). To prevent system delayed outgassing, the unit must have a device that assures that the refrigerant has been recovered from the air-conditioning system.
- 6.1.1 Testing laboratory certification of the equipment capability is required which shall process contaminated refrigerant samples at specific temperatures.
- 6.2 The equipment must be preconditioned by processing 13.6 kg (30 lb) of the standard contaminated refrigerant at an ambient of 21 °C (70 °F) before starting the test cycle. Sample amounts are not to exceed 1.13 kg (2.5 lb) with sample

amounts to be processed at 5 min. intervals. The test method fixture, depicted in Figure 1 to appendix A of this subpart, shall be operated at 21 °C (70 °F). Contaminated refrigerant samples shall be processed at ambient temperatures of 10 and 49 °C, without equipment shutting due to any safety devices employed in this equipment.

- 6.2.1 Standard contaminated refrigerant, 13.6 kg (30 lb) sample size, shall consist of liquid refrigerant with 1000 ppm (by weight) moisture at 21 °C and 45,000 ppm (by weight) of oil (total of one-third mineral oil 525 suspension nominal, one-third PAG with 100 cSt viscosity at 40 °C or equivalent, and one-third POE with 68 cSt viscosity at 40 °C or equivalent) and 1000 ppm by weight of noncondensable gases (air). Refrigerant shall be identified prior to the recovery process to $\pm 2\%$ of the original manufacturer's formulation submitted to, and accepted by, EPA under its Significant New Alternatives Policy program, with the exception that any flammable components shall be identified to $\pm 1\%$.
- 6.3 Portable refillable containers used in conjunction with this equipment must meet applicable DOT Standards.
 - 6.3.1 The container color must be gray with a yellow top to identify that it contains used refrigerant. It must be permanently marked on the outside surface in black print at least 20 mm high "DIRTY [NAME OF REFRIGERANT]—DO NOT USE, MUST BE PROCESSED".
 - 6.3.2 The portable refillable container shall have a unique thread connection for the specific refrigerant.
 - 6.3.3 During operation, the equipment shall provide overfill protection to assure that the storage container liquid fill does not exceed 80% of the tank's rated volume at 21 °C per DOT Standard, 49 CFR 173.304, and the American Society of Mechanical Engineers.
- 6.4 Additional Storage Tank Requirements
 - 6.4.1 The cylinder valve shall comply with UL 1769.
 - 6.4.2 The pressure relief device shall comply with CGA Pamphlet S-1.1.
 - 6.4.3 The container assembly shall be marked to indicate the first retest date, which shall be 5 years after date of manufacture. The marking shall indicate that retest must be performed every subsequent 5 years. The marking shall be in letters at least 6 mm high.
- 6.5 All flexible hoses must meet SAE J2196 for service hoses except that fittings shall be unique to the applicable refrigerant.
- 6.6 Service hoses must have shutoff devices located within 30 cm of the connection point to the system being serviced to minimize introduction of noncondensable

gases into the recovery equipment during connection and the release of the refrigerant during disconnection.

- 6.7 The equipment must be able to separate the lubricant from the recovered refrigerant and accurately indicate the amount removed from the simulated automotive system during processing in 30 mL units.
 - 6.7.1 The purpose of indicating the amount of lubricant is to ensure that a proper amount of new lubricant is returned to the mobile air conditioning system for compressor lubrication.
 - 6.7.2 Refrigerant dissolved in this lubricant must be accounted for to prevent system lubricant overcharge of the mobile air-conditioning system.
- 6.8 The equipment must be capable of continuous operation in temperatures of 10 to 49 °C and must comply with 6.1 and 6.2.
7. For test validation, the equipment is to be operated according to the manufacturer's instructions.

Application

The purpose of this standard is to provide equipment specifications for the recovery of any refrigerant other than CFC-12 or HFC-134a for return to a refrigerant reclamation facility that will process it to ARI Standard 700-93 (or for recycling in other EPA approved recycling equipment, in the event that EPA in the future designates a standard for equipment capable of recycling refrigerants other than CFC-12 or HFC-134a).

Reference Section

SAE J639—Vehicle Service Coupling
SAE J2196—Service Hoses for Automotive Air-Conditioning
ARI 700-93—Specifications for Fluorocarbon Refrigerants
CGA Pamphlet S-1.1—Pressure Relief Device Standard Part 1—Cylinders for Compressed Gases
UL 1769—Cylinder Valves
49 CFR 173.304—Shippers—General Requirements for Shipment and Packagings

[62 FR 68055, Dec. 30, 1997]

Subpart C—Ban on Nonessential Products Containing Class I Substances and Ban on Non-essential Products Containing or Manufactured With Class II Substances

SOURCE: 58 FR 69675, Dec. 30, 1993, unless otherwise noted.